Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)
	)
Revision of Part 15 and Part 18 of the	)
Rules regarding the Out-of-Band Emissions	)
of Radio Frequency Devices	)
	)

Petition for Rulemaking

Patrick L. Donnelly
Sirius Satellite Radio Inc.
Senior Vice President and
General Counsel

Robert D. Briskman
Sirius Satellite Radio Inc.
Technical Executive
Sirius Satellite Radio
1221 Avenue of the Americas
New York, NY 10020
(212) 584-5210

Nicholas Allard
David Leive
Edward Correia
Tonya Rutherford

Counsel for Sirius Satellite Radio Inc.
Latham & Watkins
555 11th Street, N.W.
Suite 1000
Washington, D.C. 20004
(202) 637-2200

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SUMMARY

Sirius Satellite Radio Inc. (Sirius) proposes in the following Petition for Rulemaking that the Commission revise its Part 15 and Part 18 rules regulating the out-of-band emissions of radio frequency devices. The number and the type of devices qualifying under Part 15 and Part 18 have increased significantly in recent years, raising potential major risks to the spectrum sharing regime foreseen by the Commission when it reformed Part 15 and Part 18 in the 1980s. The risks of harmful interference with licensed users will increase even further with the proliferation of wireless networking devices, such as Bluetooth, IEEE 802.11b, and products such as Home RF (collectively, "wireless devices"), RF lighting, and Ultra-wideband (UWB) devices. When the Commission revised its Part 15 and Part 18 rules in the late 1980s, most of the typical Part 15 and Part 18 devices remained relatively fixed in location and essentially operated behind walls, thereby limiting the opportunity for interference with other unlicensed devices and licensed services. However, with the proliferation of Part 15 and Part 18 devices, many of which do not remain fixed in location or operate behind walls, the Commission's current rules simply are not sufficient to protect licensed services from individual and cumulative interference. In the absence of tighter out-of-band emission limits on Part 15 and Part 18 devices, licensed users will suffer significant degradation in quality of service.

Sirius anticipates that a significant number of devices currently or proposed to be operating under Part 15 and Part 18 will cause harmful interference to SDARS receivers. In reliance on the Commission's various pronouncements that SDARS should be protected from interference, Sirius and XM Radio built and launched their satellite systems at a cost of over $3 billion and spent close to $200 million at auction for the license to operate without harmful interference. If the Commission fails in its duty to ensure SDARS interference protection from Part 15 and Part 18 devices, the rapid deployment of digital audio radio services will be

significantly threatened. In order to afford necessary protection to SDARS receivers, the Commission should modify its Part 15 and Part 18 rules to require that the aggregate free space field strength of co-polarized out-of-band, radiated emissions from Parts 15 and 18 devices between 2320 and 2345 MHz not exceed 8.6 μV/m at 3m (18.7 dBμV/m), as measured in a 1 MHz bandwidth. Sirius recommends that this limit go into effect 18 months following the date of final adoption of the rule and apply to all devices manufactured thereafter.

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PETITION FOR RULEMAKING

Sirius Satellite Radio Inc. ("Sirius" or "Petitioner"), through its attorneys, hereby submits the following Petition for Rulemaking to revise Part 15 and Part 18 of the Commission's rules regulating the out-of-band emissions of radio frequency ("RF") devices.

I. PETITIONER

Satellite CD Radio Inc., a wholly owned subsidiary of Sirius, holds a license issued by the Commission to provide satellite digital audio radio service ("SDARS" or "satellite DARS"). In 1995, the Commission allocated spectrum in the 2310-2360 MHz band for SDARS.[1] Sirius and XM Radio, Inc. were the two successful bidders in the SDARS licensing auction. In 1997, the Commission authorized Sirius to launch and operate a satellite system in order to provide SDARS in the 2320-2332.5 MHz frequency band.[2] SDARS will provide continuous nationwide multichannel radio programming with digital sound transmission and

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1 *Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services,* Report and Order, 10 FCC Rcd 2310 (1995). The Commission later modified this order to allocate the 2320-2345 MHz band to two SDARS providers. *See Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services,* Report and Order, 10 FCC Rcd 2310 (1995); *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking,* IB Docket. No. 95-91, 12 FCC Rcd. 5754 (rel. March 3, 1997) ("*1997 SDARS Order*").

2 *Satellite CD Radio, Inc. Application for Authority to Construct, Launch and Operate Two Satellites in the Satellite Digital Audio Radio Service,* Order and Authorization, 13 FCC Rcd 7971 (1997).

increase both the availability of programming to underserved communities and the variety of programming available to the public in general. Sirius has successfully launched all three of its authorized in-orbit satellites, and expects to begin commercial service for consumers early this year.

II. REQUEST FOR RULEMAKING

The implementation of the Part 15 and Part 18 rules has been a tremendous success in that it has allowed the speedy introduction of many devices that are of great benefit to consumers. However, this very success means that the number and the type of devices qualifying under Part 15 and Part 18 have increased significantly in recent years, raising potential major risks to the spectrum sharing regime foreseen by the Commission when it reformed Part 15 and Part 18 in the 1980s. Moreover, it is almost certain that there will be much greater numbers and types of these devices in the next few years. Thus, the risks of harmful interference with licensed users will increase even further with the proliferation of wireless networking devices, such as Bluetooth, IEEE 802.11b, and products such as Home RF (collectively, "wireless devices"), RF lighting, and Ultra-wideband (UWB) devices.

In light of the burgeoning types and numbers of these interferers, the Commission needs to adopt immediately more stringent limitations on their out-of-band emissions. Companies that are now developing devices in anticipation that they will be approved under Part 15 or Part 18 should be given notice of such revised regulations so they can modify their products, if necessary, in order to comply with these revised standards. This also would permit the Commission to guide effectively the development of new devices and minimize the disruptive effect on companies' business plans from major changes to the rules in the future. While some Part 15 and Part 18 wireless devices already have appeared in hotels, shopping malls, golf courses, and airports, forecasters expect that the number of wireless

devices will greatly increase over the next four years,[3] particularly as use of these devices becomes commonplace among individual consumers. The Commission should now address the potential interference issues between these devices and licensed services before major interference problems occur.

The Commission is presently conducting a number of discrete proceedings examining Part 15 and Part 18 regulations. For example, the Commission recently proposed to modify limits and restrictions on emissions from certain unlicensed devices in the frequency range above 38.6 GHz. In addition, the Commission has initiated proceedings to modify rules regarding spread spectrum communication, RF lighting and UWB devices. Some of these devices exist today and can be tested; others do not exist and can be tested only by indirect, potentially unreliable techniques. The current consideration of a broad category of devices that require substantial bandwidth to operate on an unlicensed basis (i.e., UWB) raises serious interference concerns. While all these proceedings are certainly warranted and will provide the Commission with useful information, they do not address the overall, cumulative effect of out-of-band emissions by Part 15 and Part 18 devices on licensed users.

No single incumbent provider, or even industry, has the perspective (and incentive) to propose a detailed approach for regulation of out-of-band emissions by all Part 15 and Part 18 devices. Consequently, in order to protect SDARS receivers from interference, Petitioner proposes herein a specific approach limited to regulation of out-of-band emissions by Part 15 and Part 18 devices. The focus of this Petition is on the impact of Part 15 and Part 18 devices that operate in the 2.4 GHz band and elsewhere in the spectrum. Consequently, it is

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[3] Cahners In-Stat Group, Press Release, "Bluetooth Chips Kick Butt," dated Dec. 5, 2001.

probable that other companies or industries will wish to provide the Commission with their particular perspective on the regulation of these devices.

III. EMERGING CHALLENGES TO PART 15 AND PART 18 REGULATION

A. History of Part 15 and Part 18

Part 15 of the Commission's rules governs the operation, manufacture, and marketing of unlicensed radio frequency devices. While Part 15 devices are expected to accept interference caused by the operation of a licensed radio station; another intentional or unintentional radiator; industrial, medical, and scientific equipment; or an incidental radiator,[4] they may not cause harmful interference to licensed services.[5] The rules state in absolute terms that operation of Part 15 devices is subject to the condition that "no harmful interference is caused."[6] The rules acknowledge, however, that the emission limits specified in Part 15 will not prevent all instances of harmful interference.[7] Should harmful interference occur to licensed users of the radio frequency spectrum, even if the device is operating within the emission limits, the rules specify that the operator of the offending Part 15 device shall cease operation.[8] To decrease the likelihood of interference, Part 15 transmitters generally are restricted to very low field strengths.

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4 47 C.F.R. § 15.5.

5 47 C.F.R. § 15.5(b).

6 *Id.* Harmful interference is defined as "any emission, radiation, or induction that . . . seriously degrades, obstructs, or repeatedly interrupts a radio communications service operating in accordance with this chapter." 47 C.F.R. § 15.3(m).

7 47 C.F.R. § 15.15(c).

8 47 C.F.R. §§15.5(c), 15.15(c).

The Commission historically has viewed Part 15 as providing a valuable tool to encourage innovation in new technologies.[9] By allowing devices that employ relatively low level RF signals to operate on an unlicensed basis, delays in moving devices to market and the costs on innovating parties are greatly reduced. Indeed, the Commission's policy of allowing Part 15 devices to be marketed and sold without a license has contributed to the tremendous success of Part 15 innovation. As the Commission itself has recognized, it must balance the needs of the public for the services provided by Part 15 devices with its obligation to ensure that these unlicensed devices do not cause interference to licensed services.[10] Indeed, the Commission has acknowledged that technological advancements will require it to revisit its Part 15 rules periodically, stating that "early standards adopted to control interference are frequently significantly different than what is needed at the present time due to improvements in equipment, such as receiver sensitivity, the increased proliferation of both licensed and non-licensed operations, and changes to the frequency allocations of authorized radio services."[11] In fact, as part of its 1989 overhaul of the Part 15 rules, the Commission declined to increase the permissible power level and the maximum length of the antenna in certain bands, concluding that the proposals increased the potential for interference.[12] The Commission concluded that, unless specified otherwise in the Part 15 rules, the field strength of radiated emissions from

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9 *Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, First Report and Order, 4 FCC Rcd 3493, at 3495 (1989) (*Part 15 1989 Order*) at ¶¶ 6-12.

10 *Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, First Report and Order, 4 FCC Rcd 3493, at ¶ 6 (1989) (*Part 15 1989 Order*).

11 *In the Matter of Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License*, Notice of Proposed Rulemaking, 2 FCC Rcd 6135, ¶ 4 (1987).

12 *Part 15 1989 Order* at ¶ 32.

intentional radiators operating above 960 MHz at a distance of 3 meters shall not exceed 500 uV/m.[13]

Part 18 of the rules governs the operation, manufacture, and marketing of industrial, scientific, and medical ("ISM") devices that emit RF energy. A general condition of the rules is that Part 18 devices may not cause harmful interference to a licensed radio service operating outside of the ISM band.[14] The rules further provide that, if an ISM operator causes harmful interference to radio services, it shall promptly correct the problem.[15] Many Part 18 ISM devices operate in the 2.4 GHz band.

As with its regulation of Part 15 devices, the Commission has demonstrated its commitment to ensuring that Part 18 ISM equipment does not cause harmful interference to licensed services. In fact, the Commission initially adopted its Part 18 rules in 1946 to protect radio communication services from receiving interference from the operation of ISM equipment.[16] At that time, typical Part 18 equipment included industrial, scientific, or medical machines that generated high power and operated on low frequencies. Although suited for classical ISM equipment, the Commission also applied the Part 18 technical standards to consumer products.[17] Nevertheless, the Commission recognized that, due to the proliferation of

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13 47 C.F.R. § 15.209(a).

14 47 C.F.R. § 18.111.

15 47 C.F.R. § 18.115(a). The Commission has authority to prevent harmful interference from ISM devices to licensed radio services. 47 C.F.R. § 18.101.

16 *Overall Revision of the Rules Regarding Industrial, Scientific, and Medical (ISM) Equipment under Parts 0, 2, and 18*, Third Report and Order, 58 RR 2d 1096 (1986) at ¶ 1 (noting that the Commission adopted its regulations concerning ISM equipment in 1946 to protect radiocommunication services from receiving interference from the operation of ISM equipment).

17 Part 18 consumer devices include microwave ovens, jewelry cleaners, and ultrasonic humidifiers.

these consumer products, the standards "might not be appropriate in the coming years to protect authorized and licensed services."[18]

While the Commission concluded in 1987 that the Part 18 limits on radiation levels from RF lighting devices were sufficient to protect highly susceptible services such as AM broadcasting and amateur radio from harmful interference, in view of the constantly changing RF lighting technology, the Commission stated that it would "monitor the development of such devices to insure that they continue to operate without causing harmful interference to telecommunication services."[19] In 1998, the Commission initiated the RF lighting proceeding, stating that in proposing to amend its rules, it sought to "reduce unnecessary regulatory burden and to support the introduction of new and beneficial products while ensuring that spectrum-based communications services continue to be protected from interference."[20]

B. Growing Threat of Interference from Parts 15 and 18 Devices

Since the 1980s, when the Commission revised the regulatory structure of Part 15 and Part 18, the number of unlicensed devices, particularly those operating in the 2.4 GHz band, has exploded to levels unimaginable at the time. The proliferation of these devices is due, in part, to the unlicensed regulatory framework which allows manufacturers to deliver their products to market more swiftly and more cheaply than if the devices were subject to a licensing regime. Indeed, taking full advantage of this framework, the number of unlicensed devices is expected to increase dramatically in the near future. Manufacturers of devices using wireless

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18 *Overall Revision of Part 18 Governing Industrial, Scientific, and Medical (ISM) Equipment*, Third Notice of Proposed Rulemaking, 99 FCC 2d 750 (1984) at ¶ 3.

19 *FCC Regulations Concerning RF Lighting Devices*, Report and Order, 2 FCC Rcd 6775 (1987) at ¶ 20.

20 *In re 1998 Biennial Regulatory Review – Amendment of Part 18 of the Commission's Rules to Update Regulations for RF Lighting Devices*, Notice of Proposed Rulemaking, 13 FCC Rcd 11307 (1998).

networking protocols, such as Bluetooth, IEEE 802.11b standard, and Home RF, are expected to saturate the consumer electronic market by the millions. UWB devices and RF lighting may also be ubiquitous. All these developments increase the likelihood of interference with licensed services operating in adjacent bands and make it particularly important for the Commission to consider the cumulative interference effect of multiple devices.

Bluetooth. Bluetooth is a protocol standard that utilizes short range radio technology and fast frequency-hopping spread-spectrum technology to establish a wireless connection between electronic devices over distances up to 30 feet. Devices that use this technology are approved for use on an unlicensed basis in the 2.4 GHz band. Bluetooth eliminates the need for cables at such distances, and can be used to connect wireless phones, handheld devices, personal computers, and personal digital assistants. For example, a mobile phone could connect with a desktop or laptop using the Bluetooth transmission standard to access the Internet over the phone's mobile data system – all without the use of a connecting cable. Significantly, Bluetooth does not require that the electronic devices be within line of sight, unlike infrared technology. Cahners In-Stat Group predicts 780 million Bluetooth-enabled devices will enter the market by 2005.[21] Some of the first products will include Bluetooth embedded mobile phones and notebook PCs as well as adapters, which will add Bluetooth networking technology to existing computers.[22] Forecasters predict that in 2003, 70% of smart mobile phones shipped to the United States and Europe will employ Bluetooth

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21 Cahners In-Stat Group, Press Release, "Bluetooth Chips Kick Butt," dated Dec. 5, 2001.

22 *Id.*

technology.[23] Cahners In-Stat Group further predicts that Bluetooth networking technology will become standard not only in phones, computers, and printers, but in cars and planes as well.[24]

IEEE 802.11b. The IEEE 802.11b standard was developed to maximize interoperability between differing wireless local area networks. It also uses frequencies in the 2.4 GHz band to transmit data either through direct sequence spread spectrum or frequency hopping spread spectrum. Wireless ethernet access systems are now available in airports, hotels, and conference centers, and permit anyone who has a notebook computer and a 802.11b-compatible network interface card to access the Internet and e-mail. Primarily aimed at the office environment, the 802.11b standard is designed to provide an employee with wireless access to the corporate data network regardless of the employee's location.

Home RF. A networking protocol similar to 802.11b, Home RF is aimed at home computing needs. It, too, will employ spread spectrum frequency hopping in the 2.4 GHz band, enabling high-speed wireless communications in the home to integrate data, voice, and video communications for wireless cable modems, personal multimedia communicators, and gaming devices.

UWB Devices. Unlike Bluetooth, IEEE 802.11b, and Home RF, UWB is not a networking protocol but rather the overarching term for a wide range of devices that emit relatively low level signals across very wide bandwidths—often 1 GHz or more. Although there is enormous variety in the characteristics and effects of each UWB signal, UWB devices generally use extremely narrow modulating pulses to create wideband emissions for support of various applications. For example, using the pulses to code information can support short-range

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[23] *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services* Table 1.

[24] Henry Norr, "The final Bluetooth question," San Francisco Chronicle, D1, June 11, 2001.

communications devices (for example, wireless LANs). UWB signals can act as short-distance radar, and at least one company is developing UWB automotive collision radars. In addition, because UWB signals can penetrate objects, UWB devices are used to operate ground penetrating radars and through-wall imaging devices.

RF Lighting. RF lighting devices produce light by using RF energy to stimulate gases contained inside a lamp. In 1985, the Commission classified RF lighting devices as Part 18 ISM equipment. Recent developments and advances in RF lighting technology are asserted to offer economic and environmental benefits for consumers and industry. These energy-saving, microwave-powered light bulbs claim to have increased lighting efficiency and claim improved energy conservation. RF lighting technology will be deployed in indoor and outdoor locations, such as street lamps. RF lamps also will operate in the 2.4 GHz band.

C. Growing Potential for Interference to Licensed Services

When the Commission revised its Part 15 and Part 18 rules in the late 1980s, most of the typical Part 15 and Part 18 devices remained relatively fixed in location and essentially operated behind walls, thereby limiting the opportunity for interference with other unlicensed devices and licensed services. Since the 1980s, however, the opportunity for individual and aggregate interference to *licensed* spectrum use has increased due to the proliferation of these devices and their use outdoors. If forecasters are even remotely correct in their predictions regarding the extent to which these devices will be used, the potential for individual and aggregate interference from such devices with licensed services is substantial. Even if the forecasters' predictions are proven to have been overly ambitious, the mere fact that a very large share of these devices will be deployed in mobile environments, including cars, increases the likelihood that unlicensed devices will cause interference to licensed services. Once wireless devices are deployed and placed in the hands of consumers, it will be nearly

impossible to locate the sources of interference. Moreover, a rule requiring that operators of Part 15 devices causing harmful interference to licensed services, such as SDARS receivers, cease operation until the problem has been corrected will be virtually impossible to enforce. Indeed, the Commission recently expressed increased concern about interference from Part 15 devices on licensed services in the UWB proceeding and from Part 18 devices on licensed services in the RF lighting proceeding.[25] Petitioner urges the Commission to modify its rules regarding out-of-band emissions to reflect present-day technological realities, as the current regulations no longer provide sufficient interference protection for licensed systems.

The Commission has not addressed the effect of cumulative interference from Part 15 and Part 18 devices on licensed services. The emission limits in the Part 15 rules were established based on the potential interference from a single Part 15 device and do not take into account cumulative effects that could occur if there is a high level of equipment proliferation.[26] Consequently, Petitioner makes specific recommendations for limits on out-of-band emissions from both single and multiple unlicensed devices that may affect the SDARS band.

The Commission recently has appeared open to address the issue of cumulative interference from Part 15 and Part 18 devices on licensed services. In the UWB proceeding, the Commission sought comment on the potential for harmful interference due to the cumulative impact of emissions if there is a large proliferation of UWB devices, and whether the

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25 *In re 1998 Biennial Regulatory Review – Amendment of Part 18 of the Commission's Rules to Update Regulations for RF Lighting Devices*, 13 FCC Rcd 11307 (1998) (stating "We are particularly concerned that this energy could cause interference to other services operating near the 2450 MHz band, such as the Digital Audio Radio Service operating in the 2320-2345 MHz frequency band. We note that the radiated emissions limits for RF lighting devices between 30 and 1000 MHz were originally adopted based upon the Part 15 radiated limits for digital devices.").

26 *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, Notice of Inquiry, 13 FCC Rcd 16376 (1998) (acknowledging that the Part 15 rules do not take into account cumulative effects that could occur if there is a high level of equipment proliferation).

cumulative impact could result in an unacceptably high increase in the background noise level.[27] As a possible solution, the Commission requested comment on whether it should limit proliferation by restricting the types of devices, or if it should permit manufacturers to design devices for any application as long as the equipment meets the standards.[28] In addition, last year, the FCC's Technological Advisory Council began a spectrum working group to study noise floor issues.[29]

The record in the UWB proceeding demonstrates the increasing danger of individual and cumulative interference to licensed services from Part 15 and Part 18 devices. As currently contemplated by the Commission's proposal, UWB devices (even if only certain types were allowed) would be unlicensed Part 15 devices.[30] Under these conditions, and by the nature of their intended use as consumer devices, UWB devices would certainly become ubiquitous.

However, as indicated by numerous tests submitted in the UWB proceeding, these devices can cause harmful interference to licensed systems, both individually and in the aggregate. For example, UWB signals have been shown to interfere with PCS handsets, even at significant distances, by reducing the link margin sufficiently to disrupt signals and cause dropped calls.[31] Qualcomm is currently analyzing the cumulative effect of UWB emissions on PCS phones. The effect of UWB emissions on PCS, as well as on GPS, can be assumed to have a similar effect on satellite DARS because all three systems' receivers share certain operating

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27 *Id.*

28 *Id.*

29 Report, Seventh Meeting of the FCC Technological Advisory Council, (Dec. 6, 2000).

30 *Id.*

31 *See* Dr. Samir S. Soliman, *Report of Qualcomm Incorporated*, ET Docket No. 98-153 (filed March 8, 2001), at 10.

characteristics, such as an omnidirectional receive pattern and low link margins. Other systems that share some or all of these same characteristics (radio-astronomy, satellite VSAT terminals and amateur radio, for example, which rely on low noise-figure receivers) also would be harmed by the ubiquitous signals of UWB devices if permitted to operate under Part 15.

The individual and cumulative interference effect of UWB devices on GPS receivers is well established. Reports submitted by NTIA, DOT, and the University of Texas/Johns Hopkins University indicate that UWB signals can disrupt operation of GPS receivers, at significant distances (up to 15 meters in some cases), by causing them to lose lock on satellites.[32] The NTIA has noted that the aggregate signal strength produced by multiple UWB signals is based on the sum of the average power of the signals.[33] As the tests submitted in the UWB proceeding show, proliferation of unlicensed Part 15 UWB devices would cause significant interference problems for SDARS, GPS receivers, radio astronomy, amateur radio, satellite VSAT terminals, hybrid PCS/GPS handsets (designed to provide E-911 service), PCS and, almost certainly, other licensed systems as well.

With the proliferation of devices currently or proposed to be operating under Part 15 and Part 18, the Commission's current rules simply are not sufficient to protect licensed services from individual and cumulative interference. In the absence of tighter out-of-band emission limits on Part 15 and Part 18 devices, licensed users will suffer significant degradation in quality of service.

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32 *See* NTIA Special Publication 01-45, *Assessment of Compatibility between Ultrawideband (UWB) Systems and Global Positioning System (GPS) Receivers*, David S. Anderson, et al., ET Docket 98-153 (February 2001) ("*NTIA Report*"); Potential Interference to GPS from UWB Transmitters, Ming Luo et al., ET Docket 98-153 (October 2000) (Test sponsored by DOT); Johns Hopkins University/Applied Physics Laboratory, *Final Report: UWB-GPS Compatibility Analysis Project*, ET Docket 98-153 (March 2001).

33 *See* NTIA Report at xx.

IV. IMPACT ON SATELLITE DARS RECEIVERS

Petitioner anticipates that a significant number of Part 15 and Part 18 devices will cause harmful interference to SDARS receivers.[34] Because most SDARS receivers will be located in SDARS subscribers' vehicles, wireless devices will operate in close proximity to highly sensitive SDARS receivers, thereby significantly increasing the likelihood that they will compromise the effectiveness of these receivers. For example, if a SDARS subscriber uses his wireless phone or personal digital assistant in his car, the chances of interference are greatly increased because the wireless data device is in close proximity to the sensitive SDARS receiver. RF lamps mounted over roadways or parking lots will also be close to these receivers. UWB devices may be located in vehicles, either as permanent equipment for anti-collision radar or as portable devices carried and used by passengers.

As Petitioner explains in Section V below, Part 15 and Part 18 devices that place interfering signals into SDARS' licensed spectrum at a field strength above 8.6 μV/m at 3m (18.7 dBμV/m) measured in a 1 MHz bandwidth in the SDARS band will interfere with SDARS receivers.[35] Consequently, Petitioner requests that, in order to afford necessary protection to SDARS receivers, the Commission modify its Part 15 and Part 18 rules to require that the aggregate free space field strength of co-polarized radiated emissions from Parts 15 and 18 devices between 2320 and 2345 MHz not exceed 8.6 μV/m at 3m (18.7 dBμV/m) as measured in a 1 MHz band.[36]

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[34] As discussed in Section V, the current field strength limitations for Part 15 and Part 18 devices do not provide sufficient protection for SDARS receivers.

[35] See also Motion to File Joint Supplemental Comments of Sirius Satellite Radio Inc. and XM Radio, (filed May 4, 2001) in ET Docket 98-42.

[36] Petitioner notes that its proposed field strength limitations should not apply to Part 15 and Part 18 devices that are currently on the market. By applying the proposed field strength limitations to products sold 18 months after a final rule is published, Petitioner's proposal affords manufacturers of future unlicensed devices sufficient opportunity to modify their products to accommodate the proposed limitations.

A. SDARS Reliance on Freedom from Harmful Interference

For more than 10 years, the Commission has recognized the legitimate need for interference protection for SDARS.[37] In reliance on the Commission's various pronouncements that SDARS should be protected from interference, Sirius and XM Radio built and launched their satellite systems at a cost of over $3 billion and spent close to $200 million at auction for the license to operate without harmful interference.

The need for interference protection for the SDARS band is reflected in the Commission's successful efforts to obtain recognition of the international SDARS frequency allocation in the United States, as well as in the Commission's own domestic frequency allocation proceeding. Of particular concern to the Commission was that SDARS not be subject to "unacceptable interference from ISM equipment."[38] Similarly, the Commission's commitment to interference protection for SDARS is reflected in the coordination agreements negotiated with the governments of Canada and Mexico, which ensure that those countries do not significantly interfere with SDARS receivers.[39] Moreover, the Commission expressly stated

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37 *See infra* n. 38-42.

38 *An Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum*, Report, 6 FCC Rcd 3900, at ¶ 74 (1991).

39 *See Agreement Between the Government of the United States of America and the Government of the United Mexican States Concerning the Use of the 2310-2360 MHz Band* (July 24, 2000) ("*U.S.-Mexico DARS Agreement*"); Letter from Michael Binder, Assistant Deputy Minister, Spectrum, Information Technologies and Telecommunications, Industry Canada to Ambassador Vonya B. McCann, U.S. Coordinator and Deputy Assistant Secretary, International Communications and Information Policy, U.S. Department of State (August 25, 1998); *see also United States and Canada Agree on Conditions for Implementation of U.S. Satellite Digital Audio Radio Services (DARS) and Canadian Terrestrial Digital Radio Broadcast Services (T-DRB) along the U.S./Canada Border Area*, Report No. IN 98-50, *News Release* (Sept. 3, 1998).

in its SDARS allocation order that it allocated the 2320 – 2345 MHz band for SDARS on a primary basis.[40]

In subsequent orders, the Commission continued to highlight the importance of interference protection for SDARS from devices in adjacent bands. For example, in adjusting the out-of-band emission levels for wireless communications systems ("WCS"), the Commission recognized that SDARS would not be successful if it were subject to excessive interference.[41] Acknowledging the difficulty in assessing possible interference between two systems that had not yet been deployed, the Commission stated that it would adjust the WCS emission levels if the interference from WCS licensees proved to be greater than the Commission had projected.[42]

B. Impact on Deployment and Service to Underserved Communities

If the Commission fails in its duty to ensure SDARS interference protection from Part 15 and Part 18 devices, the rapid deployment of digital audio radio services will be significantly threatened. As the Commission has noted in past orders, SDARS holds the promise of providing continuous service of digital radio in the form of 200 audio channels that will offer consumers a tremendous increase in choices of audio programming.[43] If protected from harmful interference, SDARS will dramatically reduce the disparity in access to radio by making enormous programming choices available to 45 million underserved consumers in the

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40 *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, IB Docket. No. 95-91, 12 FCC Rcd. 5754 (rel. March 3, 1997) ("*1997 SDARS Order*").

41 *See, e.g., Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Services, Memorandum Opinion and Order*, FCC 97-112, 12 FCC Rcd. 3977 (rel. Apr. 2, 1997).

42 *Id.* at ¶ 25.

43 Satellite CD Radio, Inc., Application for Authority to Construct, Launch, and Operate Two Satellites in the Satellite Digital Audio Radio Service, Order and Authorization, 13 FCC Rcd 7971 (1997) at ¶ 2; American Mobile Radio Corporation, Application for Authority to Construct, Launch, and Operate Two Satellites in the Satellite Digital Audio Radio Service, 13 FCC Rcd 8829 (1997) at ¶ 2.

US, particularly those in rural areas, who currently have access to only a small number of radio stations.

C. Protecting SDARS Receivers from Harmful Interference

Instead of requiring SDARS customers to resolve interference problems between their SDARS receivers and Part 15 and Part 18 devices on their own, the Commission should take immediate action to protect SDARS receivers from harmful interference from Part 15 and Part 18 devices. There is strong Commission precedent for doing so. Like SDARS receivers, direct broadcast satellite (DBS) home receivers are broadly deployed unlicensed devices operating as a part of a licensed service. Nevertheless, over twenty years ago the Commission took appropriate action to protect the then-nascent DBS service, including DBS home receivers.

Based on studies demonstrating that terrestrial microwave operations are likely to cause interference to DBS home receivers,[44] the Commission required some terrestrial licensees in the 12.2-12.7 GHz band to move their operations to assigned frequencies in higher bands to prevent harmful interference to DBS systems.[45] Even in those instances where the Commission permitted terrestrial users to continue operating in the 12.2 – 12.7 GHz band, the Commission nevertheless prohibited the users from causing any harmful interference to operating DBS systems. By taking prompt action to protect DBS home receivers from interference, the Commission encouraged the successful introduction of a new service, promising numerous consumer benefits such as service to remote areas, additional channels of service throughout the country, and programming better suited to viewers' tastes.

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44 *Inquiry into the Development of Regulatory Policy in regard to Direct Broadcast Satellites for the Period Following the 1983 Regional Administrative Radio Conference*, Report and Order, 90 FCC 2d 676 (1982), n.36.

45 *Id.* at ¶¶ 56-73.

Television sets are unlicensed radio frequency receivers, which the Commission protects from harmful interference. For example, in 1985 the Commission adopted rules to protect the reception of Channel 6 TV signals from harmful interference caused by noncommercial educational FM (NCE-FM) stations operating in the 88-92 MHz band.[46] There, the Commission required adjustment of the facilities permitted for the NCE-FM stations such that the amount of predicted interference to Channel 6 TV signals would be limited. In addition, the Commission imposed specific power levels on the facilities and required filter installation as a means of alleviating interference.

The Commission's efforts to protect DBS home receivers and Channel 6 TV viewers from harmful interference played a significant role in the success of those services today. The Commission should likewise encourage the successful deployment of satellite DARS by limiting the radiated emissions of Part 15 and Part 18 devices. As a licensed service, SDARS is entitled to the same level of protection afforded to DBS home receivers and Channel 6 TV stations. Indeed, SDARS is entitled to the highest level of interference protection in the case where the interfering source is a Part 15 or Part 18 device because those devices are strictly prohibited from causing harmful interference to licensed services, such as SDARS, and must cease operation if such interference occurs.

Alternatively, to require that consumers themselves resolve interference problems between their SDARS receivers and Part 15 and Part 18 devices by turning off one of the devices would be an inadequate response to the serious interference problems outlined herein. Such a laissez-faire approach assumes that the SDARS customer is the operator of the offending Part 15 or Part 18 device causing harmful interference to the SDARS receiver. This,

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[46] *Changes in the Rules Relating to Noncommercial, Educational FM Broadcast Stations*, Memorandum Opinion and Order Proceeding Terminated, 58 RR 2d 629 (1985).

however, often is not the case. For example, in the case of an RF lamp mounted over a road that interferes with a customer's SDARS receiver, the SDARS customer simply does not have any control over the operations of the RF lamp. Similarly, if a Bluetooth-enabled device being operated in the car next to an SDARS customer's car is the source of interference to the SDARS receiver, the SDARS customer has no control over the offending Bluetooth-enabled device. In both of these examples, the customer has no control over the operation of the source of interference to the SDARS receiver, and therefore would be unable to resolve the interference created by the Part 15 or Part 18 device. Indeed in both cases, the SDARS customer may not even know that a Part 15 or Part 18 device is the source of interference. Petitioner urges the Commission not to base its decision of whether to reduce the out-of-band emission levels of Part 15 and Part 18 devices on the erroneous assumption that SDARS customers can resolve the interference issues on their own.

As it did in the case of DBS and Channel 6 TV Stations, the Commission should require that Part 15 and Part 18 devices make adjustments to their technical parameters to reduce the level of interference to SDARS receivers, and thereby promote the successful deployment of SDARS. If, however, the Commission allows Part 15 and Part 18 devices to operate at their current emission levels, SDARS customers are likely to experience service disruption without even knowing the source of the interference. As a result of such continued service disruption, many SDARS customers may become dissatisfied with what they believe to be the inferior quality of the satellite radio service and discontinue their subscription to the service. In order for the service to be a success, the Commission must reduce the out-of-band emission levels for Part 15 and Part 18 devices. At the current out-of-band emission levels in

the SDARS band, the success of satellite radio service and the integrity of the Commission's auctioning process may be significantly compromised.

V. IMPACT OF INTERFERENCE ON SDARS OPERATIONS

A. Effect of Interference on SDARS Receivers.

Sirius employs three geosynchronous satellites in orbit, two of which are always transmitting, to provide service throughout the United States. XM employs two geostationary satellites to provide coverage throughout the United States. Spatial and time diversity are used by both Sirius and XM to reduce service outages from blockage, multi-path fading and foliage attenuation. The combination of these facilities and techniques are designed to provide high quality service continuity throughout the 48 contiguous United States for outdoor, mobile and indoor use.[47] XM has initiated commercial operation, and Sirius will do so early this year.

The two systems were designed to utilize efficiently the limited bandwidth available for SDARS. SDARS receivers operate in the 2320-2345 MHz band on an *exclusive* basis within the United States in accordance with the Commission's rules. Each licensee is authorized to use 12.5 MHz.[48] Both use high power satellites, which employ state of the art technology. Together with the sensitive mobile receivers, these systems have been designed to provide the necessary performance while minimizing adjacent channel interference within the United States and co-frequency interference with bordering countries. Thus, both satellite systems were designed to protect themselves from undue interference without causing interference to other licensed spectrum users or to each other.

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47 *Id.*

48 Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services, Report and Order, 10 FCC Rcd 2310 (1995).

Section 15.205 of the Commission's rules strictly prohibit Part 15 devices from operating in the 2320-2345 MHz band. Consequently, when the SDARS systems were designed, harmful interference from Part 15 devices was not anticipated. When Sirius and XM designed their systems in 1997, the widespread use of wireless devices, RF lamps, ultrawide-band devices, and other unlicensed devices whose characteristics differ greatly from traditional Part 15 and Part 18 devices, did not exist. In fact, most of the typical Part 15 and Part 18 devices in use at that time remained relatively fixed in location and operated almost exclusively behind walls. Today, in contrast, wireless devices are expected to be widely deployed in mobile environments, including cars, which will place them in close proximity to SDARS receivers. In addition, the spectral characteristics and pulse rates of UWB devices radically deviate from traditional Part 15 devices and may overlay the SDARS band;[49] therefore, possible interference from these devices within the SDARS band has only recently been considered.

Because of these developments, out-of-band emissions by Part 15 and Part 18 devices using bands nearby to SDARS spectrum must now be addressed by the Commission, particularly in the portion of the spectrum from 2400-2483.5 MHz. This band is authorized for use by a wide variety of Part 15 and Part 18 devices. The lower edge of this frequency band is only 55 MHz from the upper edge of the SDARS's authorized frequency band. If UWB devices are approved, their transmissions may overlay the SDARS band. Because the numbers, locations and signal characteristics of Part 15 and Part 18 devices have changed significantly over the last few years, out-of-band emissions at field strength levels now permitted for Part 15 and Part 18 devices will cause interference to SDARS receivers. Part 15 spread spectrum devices, such as Bluetooth and 802.11b devices, RF lamps, and potentially, UWB systems

[49] Petitioner remains opposed to any proposal that would permit UWB transmissions to overlay the SDARS band or that would allow use of UWB devices on an unlicensed basis.

under development, all can cause significant interference to SDARS receivers if they transmit signals at the currently allowed out-of-band field strength levels under Part 15 and Part 18 rules. For example, out-of-band emissions from RF lamps at a distance of three meters from a SDARS receiver at levels permitted under Part 15, produce power flux density levels over 100 times higher in the SDARS band than the satellite carrier signal.[50] Such levels of interference will result in a subscriber's loss of SDARS service.

B. Estimating Maximum Tolerable Field Strength Levels

The attached chart, Interference into SDARS Receiver System, demonstrates the interfering out-of-band field strength levels from Part 15 and Part 18 devices that can be tolerated by SDARS receivers within the SDARS band.[51] It is estimated that the maximum acceptable power density level at the input to the receiver from aggregate interfering Part 15 and Part 18 sources is −152.6 dBW/MHz or a field strength emission of approximately 8.6 μV/m at 3m (18.7 dBμV/m) for free space, co-polarized conditions, as measured in a 1 MHz bandwidth.[52] This proposed Part 15 and Part 18 out-of-band interference protection level assumes free space propagation between the interferer(s) (co-polarized digital or pulse modulated interfering signals) and the SDARS receiver. While many Part 15 and Part 18 devices will operate under conditions where there is attenuation of outdoor transmissions because of building walls, SDARS receivers still often will be in close proximity to these

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50 Sirius and XM have previously submitted calculations to the Commission demonstrating that, if RF lighting devices are permitted to operate at the current Part 15 out-of-band limitation of 500 μV/m at 3m (54 dBμV/m), a SDARS receiver would have to be 280 meters from the device in order for the receiver to avoid interference. Letter to Ms. Magalie Roman Salas, Secretary, Federal Communications Commission, re: Ex Parte Presentation of Sirius Satellite Radio Inc. and XM Radio Inc., ET Docket No. 98-42, June 29, 2001.

51 The technical characteristics of these receivers were part of the licensing application submitted by Sirius and approved by the Commission in 1997.

52 Part 15 uses a 3 meter separation distance as a reference point.

devices with no intervening structure because of their co-location in vehicles and homes. Consequently, we believe it is appropriate to base maximum Part 15 and Part 18 devices' overall out-of-band field strength limitations on free space conditions. To the extent that specific Part 15 and Part 18 devices can be identified as unlikely to be free space line-of-sight, such as automotive in-cabin devices,[53] or of different polarization or modulation, higher out-of-band interference levels can be selectively authorized. The discussion below explains how the maximum out-of-band field strength limitation was determined.

In order for SDARS receivers to operate, there must be sufficient received satellite signal power above the noise floor of the receiver to achieve a minimum required carrier-to-noise (C/N) ratio, as well as a margin above this ratio to overcome multi-path fading and foliage attenuation effects and an allowance for potential sources of interference, such as Part 15 or Part 18 devices and terrestrial interference. These factors, both individually and collectively, cause degradation of the received signal. While the margin provided by the current SDARS system design is adequate to provide satisfactory performance, reducing it will directly impact the service quality. The technical characteristics of the Sirius and XM SDARS systems cannot be practically changed because the 15 year lifetime satellites have been orbited, and the SDARS receivers are being deployed.

The signal received from the Sirius satellites at the edge of service coverage has a typical power flux density of -110 dBW/m^2/MHz at the mobile receiver's antenna, which is equivalent to a power density of -135.4 dBW/MHz at the receiver (the "received signal" on the

[53] For such devices, 12.5 μV/m at 3m, as measured in a 1 MHz bandwidth, would be an appropriate interference level due to the cabin's attenuation of the interference to the SDARS receiver antenna (12.5 μV/m at 3m is equivalent to 18 μV/m at 3m measured in a 2 MHz bandwidth).

chart).[54] The Sirius mobile receiver has a receiver input noise power density of –146.6 dBW/MHz (the "receiver noise floor" on the chart). The difference between the receiver noise floor and the received signal power is approximately 11.2 dB ("nominal operating C/N ratio"). Interference (I) from all sources, including Parts 15 and 18 devices which increase the receivers' noise floor (N) and the effects of multi-path fading and foliage attenuation, which decrease the received satellite carrier signal (C), will reduce the actual input C/N ratio to the SDARS receiver.

Acceptable satellite transmission service requires the digital reception to have a bit-error-ratio (BER) of 1×10^{-5} or better, which necessitates a minimum C/N of 4.5 dB. In other words, the minimum required level between the noise floor and the received satellite signal power must be at least 4.5 dB. This required carrier-to-noise ratio of 4.5 dB will be sufficient to provide the appropriate quality of service throughout the country. However, any drop below this level will result in a loss of the signal and, therefore, loss of service for the subscriber. Carrier-to-noise ratio margin above this required minimum carrier-to-noise ratio must be available to overcome fading due to multi-path, foliage attenuation, and external interference. Consequently, the combined effects of multi-path, foliage attenuation, and external interference must not exceed 6.7 dB (11.2 dB – 4.5 dB), which is identified in the far right column of the chart as the margin between the receiver noise floor and the required carrier-to-noise ratio.

Because multi-path and foliage attenuation will reduce the carrier-to-noise margin between the receiver noise floor and the received signal power, it is estimated, consistent with standard satellite engineering practices, that the combined effects of terrestrial

[54] The received signal power is based on coverage near the border of the country. These service areas include the highly populated east and west coast regions (i.e., Boston, New York, Miami, Los Angeles, San Francisco, Seattle, etc.)

and Parts 15 and 18 interference will cause significant degradation if they raise the noise floor by more than 1.0 dB (or to a level higher than -145.6 dBW/MHz), which represents a 25% increase in the receiver noise floor equating to an interference-to-noise (I/N) ratio of - 6dB. In the United States, Sirius and XM have exclusive use of their bands and should not experience terrestrial interference signals from U.S. sources. It should be noted that the herein proposed Part 15 and Part 18 aggregate interference limit is higher than the averaged limit negotiated by the FCC for terrestrial interference into SDARS receivers from Canadian and Mexican terrestrial systems near the border.[55]

In cases where there is a high probability of interference from multiple Part 15 and Part 18 devices (*e.g.*, a parking lot with many RF street lamps), it is possible for device manufacturers to derive the maximum power flux density required for a single device. In order to stay within the available margin, the I/N, as discussed above, for aggregate Part 15 and Part 18 devices should not exceed an I/N = -6 dB or an electric field strength of 8.6 μV/m at 3m (18.7 dBμV/m). There can be situations where there are multiple interfering sources to a SDARS receiver, such as more than one RF light in close proximity in a parking lot. In such situations, to ensure that the effect of multiple sources does not exceed this level, the single source interference level received at the mobile receiver antenna should not typically exceed an I/N = -10 dB or an electric field strength of 5.4 μV/m at 3m (14.6 dBμV/m).[56]

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55 *U.S.-Mexico DARS Agreement; Agreement Concerning the Coordination between U.S. Satellite Digital Audio Radio Service and Canadian Fixed Service and Mobile Aeronautical Telemetry Service in the band 2320-2345 MHz.*

56 Satellite systems typically assume between 2 and 3 simultaneous interference entries of equal power for system design purposes. Based on an assumption of 2.5 entries (average of 2 and 3), the resulting ratio between single entry and multiple entry is 4 dB. Because SDARS receivers use an omni-antenna, this ratio is appropriate; therefore, the single entry interference level represents an I/N = -6 + -4 = -10 dB. Obviously, this single entry I/N would change if fewer or greater numbers of simultaneous interference entries are anticipated.

Because the lower edge of the 2.4 GHz band is only 55 MHz from the top edge of the SDARS's spectrum, the filtering mechanism that Part 15 and Part 18 devices currently use to limit their out-of-band emissions may be insufficient to satisfy the proposed aggregate field strength limit within the SDARS band of 8.6 μV/m at 3m (18.7 dBμV/m). Petitioner does not anticipate that designing filtering mechanisms to comply with the proposed field strength limitations will be technically difficult for manufacturers of future Part 15 and Part 18 devices to accommodate.

C. Supplementing Record Regarding UWB Devices

The Commission is currently considering whether to allow widespread use of UWB devices and, if so, what frequencies would be authorized for their use. If these devices are allowed to transmit at current Part 15 out-of-band limits (500 μV/m at 3 meters) in bands that overlay SDARS, the impact on SDARS would be severe. For this reason, we have proposed, at realistic separation distances, even taking into account shielding effects from buildings, limits of 8.6 μV/m at 3m (18.7 dBμV/m) for aggregate Part 15 or Part 18 devices. However, because maximum field strength for purposes of Part 15 is an average value, it provides limited information. Thus, if UWB devices are authorized under Part 15, the record should be supplemented to include information such as out-of-band peak power levels and pulse repetition rates. This information is key to making a more accurate assessment regarding the potential interference of UWB signals on SDARS receivers. Based on such information, the standard recommended in this petition could be modified to address peak levels of such UWB signals as well as average power levels.

D. Limits on Emissions by ISM Equipment Regulated Under Part 18

The Commission's current Part 18 rules generally allow an out-of-band emission limit of 10 μV/m at 1600 meters by high power ISM equipment in the SDARS band.[57] Out-of-band emissions limits for RF lighting are specifically identified in 18.305(c). For non-consumer RF lighting equipment, the out-of-band emission limit is 70 μV/m at 30 meters (700 μV/m at 3 meters). RF lamps transmitting at either of these field strength levels will cause significant interference to SDARS receivers. Even transmissions of RF lamps that comply with the lower Part 15 out-of-band limit (500 μV/m at 3 meters) will cause significant interference unless unrealistic assumptions are made regarding minimum separation distances.[58] RF lamps with out-of-band field strengths permitted by Part 15 would have to be 280 meters from SDARS receivers in order to avoid interference.[59] Petitioner, therefore, recommends that RF lamps operating in the 2.4 GHz band as well as other Part 18 devices also should be subject to the aggregate out-of-band emission limit of 8.6 μV/m at 3m (18.7 dBμV/m) in the SDARS band, as proposed herein. As mentioned previously, because the Part 15 and Part 18 out-of-band interference protection levels assume free space propagation and co-polarization between the interferer(s) and the SDARS receiver, higher out-of-band interference levels could be authorized where specific Part 15 and Part 18 devices are likely to be shielded, operate in locations where SDARS receivers are unlikely to be co-located, or are not co-polarized.

VI. CONCLUSION AND PROPOSED RULE

As a result of the current proliferation of unlicensed devices operating under Parts 15 and 18 and the expectation of millions more devices, the Commission will soon be

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57 47 C.F.R. § 18.305(b).

58 *See supra* n. 50.

59 *Id.*

confronted with a significant increase in the number and types of Part 15 and Part 18 devices, which has the potential to cause harmful interference to licensed services. If the Commission fails to place stricter limits on radiated out-of-band emissions from future Part 15 and Part 18 devices, the public interest will be harmed and consumers will be denied the full benefits of licensed services such as SDARS.

The Commission can avoid such unfortunate consequences if it acts now before wireless devices, RF lamps and UWB devices saturate the consumer electronics market. Consequently, Petitioner strongly urges the Commission to address the out-of-band interference from such devices which may affect the SDARS band. Consistent with the analysis above and in order to afford sufficient notice to companies that currently are developing devices that may operate under Part 15 or Part 18, Petitioner requests that the Commission establish a rule to limit their aggregate field strength for out-of-band radiated emissions between 2320 and 2345 MHz to 8.6 μV/m at 3m (18.7 dBμV/m) on a free space, co-polarized basis measured in a 1 MHz bandwidth. The above limit would go into effect 18 months after the date of final adoption of the rule and apply to all devices manufactured thereafter.

Respectfully submitted,

Nicholas Allard
David Leive
Edward Correia
Tonya Rutherford

Counsel for Sirius Satellite Radio Inc.
Latham & Watkins
555 11th Street, N.W.
Suite 1000
Washington, D.C. 20004
(202) 637-2200

Patrick L. Donnelly
Sirius Satellite Radio Inc.
Senior Vice President and
General Counsel

Robert D. Briskman
Sirius Satellite Radio Inc.
Technical Executive
Sirius Satellite Radio
1221 Avenue of the Americas
New York, NY 10020
(212) 584-5210

January 23, 2002

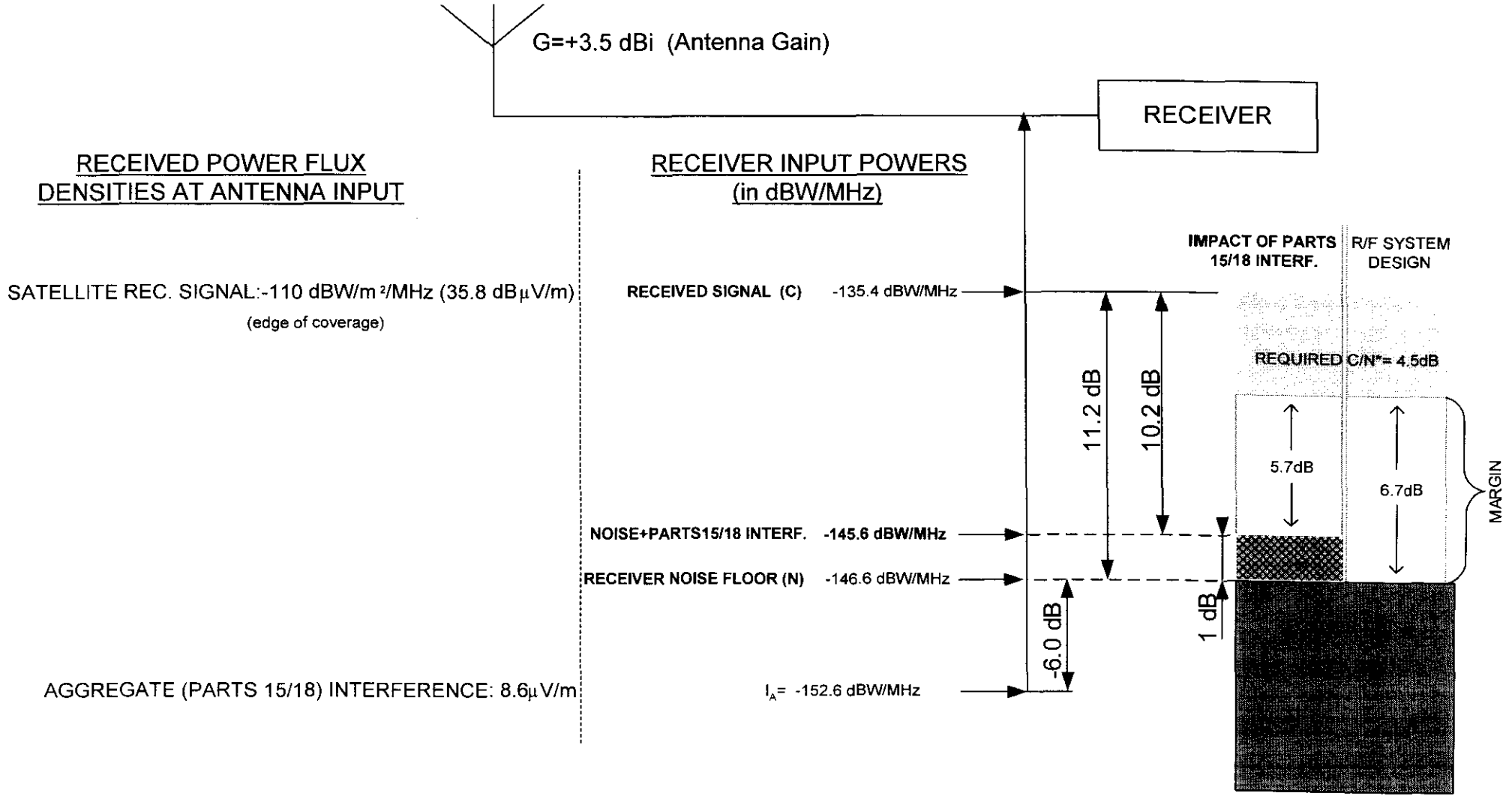
Technical Certificate

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this Petition for Rulemaking, that I am familiar with Part 15 and 18 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in this Petition for Rulemaking, and that it is complete and accurate to the best of my knowledge.

Jack L. Hicks

Jack Hicks
Vice President, Engineering
W. L. Pritchard & Co., LC

January 23, 2002



* C/N required for BER of $1x10^{-5}$ or better=4.5dB
Typical Receive C/N=11.2dB
System Margin for Propagation, etc.=6.7dB

Interference into SDARS Receiver System

Attachment 1